

## United States Patent Application For

## EXPANSION MOTOR

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What is claimed is:

1. (Amended) An external expandable holding device comprising:
  - a) first member having a external surface with an annular groove having protruding lips;
  - b) a resilient expansion sleeve is fusibly connected to the protruding lips along the edge of the annular groove; flexurally to the first member for receiving the aperture of a second member;
  - c) a fillet along the lip and fillister along the expansion area to further relieve stress;
  - d) an expansion chamber with an external leading channel is defined between the first member and the expansion sleeve for receiving fluid;
  - e) wherein fluid is by means pumped to pressurize expansion chamber thereby the expansion sleeve is deformed to engage the second member;
  - f) whereby upon release of the pressure the expansion sleeve returns to the relaxed condition to release the second member.
2. (original) The expandable device according to claim 1 wherein the holder and the expansion sleeve are cylindrical and the expansion sleeve expands radially outwardly to engage the second member.
3. (original) The expandable device according to claim 2 whereby the fluid is a liquid.
4. (omit) (Canceled)
5. (omit) (Canceled)
6. (Original)The expandable device according to claim 2 whereby the holder is a shaft, a mandrel, an arbor, a clutch, a friction brake, a coupling, a damper, or a workholder and the second part is a tool, a workpiece, a hub, or a part.
7. (Original) The expandable device according to claim 2 whereby the holder is a molded piece.
8. (Original) The expandable device according to claim 2 wherein the expansion chamber is an annular expansion chamber extending around the circumference of the holder.

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9. (Original) The expandable device according to claim 8 whereby the holding device comprises of a plurality of expansion chambers arrayed longitudinally.
10. (amended) The expandable device according to claim 2 wherein the expansion chamber extends around a portion of the circumference of the holder.
11. (amended) The expandable device according to claim 2 whereby the holding device comprises of a plurality of independent expansion chambers that are axial arrayed radially.
12. (withdrawn) The expandable device according to claim 11 whereby the holding device comprises of a plurality of independent expansion chambers arrayed longitudinally:
13. (withdrawn) An internal expandable holding device comprising;
  - a) a first member having a bore for receiving a second member;
  - b) a cover to the secured to the first member;
  - c) an expansion chamber with rounded corners to eliminate stress concentration extends to a thin wall as defined by the bore is defined within the first member between the cover;
  - d) the expansion chamber is joined by a channel to an aperture;
  - e) furthermore to reduce stress concentrations the bore surface has filsters along the thin wall;
  - f) wherein fluid is by means pumped to pressurize expansion chamber thereby the first member is deformed to exert force to the second member;
  - g) whereby upon release of the pressure the first member returns to the relaxed condition to remove the force from the second member.
14. (withdrawn) The expandable device according to claim 13 wherein the holder and the expansion sleeve are cylindrical and the expansion sleeve expands radially inward to engage the second member.
15. (withdrawn) The expandable device according to claim 14 whereby the fluid is a liquid.
16. (withdrawn) The expandable device according to claim 14 whereby the fluid is a gas.
17. (withdrawn) The expandable device according to claim 14 whereby the external surface of the resilient expansion sleeve has special holding features.

18. (withdrawn) The expandable device according to claim 14 whereby the holder is a collet, a hub, a journal, a coupling, a clutch, a friction brake, or a workholder and the second part is a tool, a workpiece, a shaft, or a part.
19. (withdrawn) The expandable device according to claim 14 whereby the holder is a molded piece.
20. (withdrawn) The expandable device according to claim 14 wherein the expansion chamber is an annular expansion chamber extending around the holder.
21. (withdrawn) The expandable device according to claim 14 wherein the expansion chamber is an annular expansion chamber extending partially around the holder.
22. (withdrawn) The expandable device according to claim 20 whereby the holding device comprises of a plurality of expansion chambers arrayed longitudinally.
23. (withdrawn) The expandable device according to claim 20 wherein the expansion chamber extends around a portion of the bore of the holder.
24. (withdrawn) The expandable device according to claim 23 whereby the holding device comprises of a plurality of expansion chambers arrayed polar radially.
25. (withdrawn) The expandable device according to claim 12 whereby the holding device comprises of a plurality of expansion chambers arrayed longitudinally.
26. (withdrawn) An external expandable lineal actuating device comprising;
  - e) first member having a external surface;
  - f) a cover is secured to the first member;
  - g) an expansion chamber with rounded corners to eliminate stress concentration extending to a thin wall is defined within the first member between the cover;
  - h) wherein expansion chamber is joined by a channel to an aperture;
  - i) furthermore to reduce stress concentrations externally the thin wall is bordered with filsters;
  - j) wherein fluid is by means pumped to pressurize expansion chamber thereby the first member is deformed to exert force to the second member;
  - k) whereby upon release of the pressure the first member returns to the relaxed condition to remove the force from the second member.
27. (withdrawn) The expandable device according to claim 26 wherein the first member is a disc and the surface of the thin wall expands engage the second member.
28. (withdrawn) The expandable device according to claim 27 whereby the fluid is a liquid.

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29. (withdrawn) The expandable device according to claim 27 whereby the fluid is a gas.
30. (withdrawn) The expandable device according to claim 27 whereby the external surface of the resilient expansion sleeve has special holding features.
31. (withdrawn) The expandable device according to claim 27 whereby the disc is a clamp, a support, a damper, a friction brake, a friction clutch, a jack or a workholder and the second part is a tool, a workpiece, or a part.
32. (withdrawn) The expandable device according to claim 27 whereby the holder is a molded piece.

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Insert 90 and flexure end 82 to bulge 70 in direction of vector arrow 70. Stress is further relieved by groove 98 spaced around the perimeter of insert 90. FIG. 7a is an example of insert 90 having a flange 92 around the inside wall 94 perimeter and a fillet 72. FIG. 8b shows the motor 1 as a molded part 99. In FIG. 8 the width of arch cavity 76 is bound with radial by thick walls 78 and the length is by longitudinal thick walls 94. Thereby arch cavity 76 has a bottom 80 and is surrounded by walls 76 and 94 having a flexure protrusion 82 ending with opening wall 92 along the top edge and has an inside surface 84 that is with a rounded corner 86 to thick wall 94. FIG. 8 shows flexure protrusion 82 ending with opening wall 92 and a rounded corner 86 to radial wall 78 and thick bottom 80. FIG. 8a the enlarged view from FIG 8 showing another construction of the motor with insert 96 having flange 72 fusible joined 89 and cavity 76.

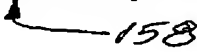
Insert 90 is shown in FIG. 9-11 with a plan view shown in FIG. 9 and an orthographic view in FIG. 10 showing a longitudinal and FIG. 11 showing a radial section.

Yet another configuration of the motor 1 according to the invention is demonstrated in FIG. 12-15 is having motor 1 configuration arrayed plural radial around the body 102. The force vectors 74 radiate approximately perpendicular to the center axis 100.

Another configuration of the motor 1 according to the invention is demonstrated in FIG. 14-16 is having a motor body 110 and thick arch sections 112. In FIG. 16 it is seen that main body has annular groove 114 with rounded corner 118 to relieve stress concentration with a remaining thin wall 122. Groove 114 partially filled with arch sections 112 and all joint fused 52 resulting in cavity 116. To further relieve stress annular inside groove 120 is grooved in inside wall 124. When cavity 116 is pressurized thin wall is expanded 118 in direction of vector arrow. FIG. 16a further demonstrates this with the enlarged view

In FIG. 17-19 another configuration of the motor 1 is shown in FIG. 17 with congruent plug 158 joined fuse 162 to body 156. In FIG. 18 thin wall 164 is deflected to bulge 150 in the direction shown by vector arrow 152. Motor 1 has a main body 156 and an opening 161 extending to a thin wall 164 with a stress relief groove 160 spaced from around the

outer perimeter of thin wall 152. It is shown that congruent plug 158 extends into opening 161 providing cavity 170. Thin wall 152 is bound with round corners 166 to further eliminate stresses. FIG. 19a is an enlarged view showing thin wall 164 bulged with stress taken by rounded corner 166 and groove 160.

in whereby expansion is area 150 in direction shown by vector arrow 152. Motor 1 has a main body 156 and a cavity 158 extending to a thin wall 152 with a stress relief groove 160 spaced from around the perimeter of local area 152. In FIG. 18 it is shown that cavity 158 to a depth to provide for a thin wall 152 with fillet corners 166 further eliminate stresses. A congruent plug ~~168~~ which provides space for cavity 170 is joined with a fusible alloy 89. 

Yet another configuration of the motor 1 according to the invention is demonstrated in FIG. 20-21 is having motor 1 configuration arrayed plural radial around the body. The force vectors 152 converge approximately perpendicular to the center axis 100.

Another configuration of motor 1 shown in FIG. 22-24 according to the invention is taught in FIG.22 whereby expansion 170 is achieved in direction of vector arrow 180. FIG. 23 shows body 168 with congruent plug 172 fused to body 168. In FIG.24 opening 174 extends to thin wall 176 with congruent plug 172 providing for cavity 178. When cavity 178 has pressure thin wall 176 has bulge 170 in direction of vector arrow 180. FIG. 24a shows thin wall 176 bulge with stress taken with round corner 182 and groove 185 spaced around thin wall 176.

The present invention may, of course, be carried out in other specific ways other than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive and all changes coming within the meaning and equivalency range of the append claims are intended to embraced therein.